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The Whale Tail Grants Program distributes funds from sales of the Whale Tail License Plate. The Whale Tail License Plate is an official "specialty" license plate issued by the Department of Motor Vehicles for cars registered in California. Proceeds from the sales of the plates benefit the California Coastal Commission's Adopt-A-Beach Program, California Coastal Cleanup Day and a wide variety of coastal and marine education projects throughout the state.

EcoHelpers has continued with federal grants from the Cooperative Conservation Initiative, Challenge Cost-Share, and Public Lands Corp programs administered by the Mountains Restoration Trust. The Trust is committed to preserving, protecting and enhancing the natural resources of the Santa Monica Mountains through land acquisition, cooperative planning, restoration, education and recreation programs.





Santa Monica Mountains National Recreation Area

“The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.”

-National Park Service Mission Statement

Santa Monica Mountains National Recreation Area protects the greatest expanse of the Mediterranean ecosystem in the National Park Service. The Mediterranean climate is characterized by hot, dry summers and relatively mild, wet winters. This unique ecosystem is found in only four other places in the world—central Chile, southwestern Australia, southern Africa and the Mediterranean Basin in Europe—comprising approximately 2% of the world’s landforms. The park is home to 26 distinct natural communities, from freshwater aquatic habitats and coastal lagoons to oak woodlands, valley oak savanna and chaparral. It is a critical haven for more than 450 animal species and 25 rare, threatened or endangered species. It also has more than 1,000 archeological sites, one of the highest densities of archaeological resources found in any mountain range in the world. No other national park unit features such a diverse assemblage of natural, cultural, scenic and recreational resources within easy reach of 17 million Americans of the Los Angeles area.

In 1978, Congress established Santa Monica Mountains National Recreation Area to be managed, “...in a manner which will preserve and enhance its scenic, natural and historical setting and its public health value as an airshed for the southern California metropolitan area while providing for the recreational and educational needs of the visiting public.”

Santa Monica Mountains National Recreation Area is preserved by a cooperative effort of over 70 governmental agencies, including the National Park Service, Santa Monica Mountains Conservancy and California State Parks. These agencies, along with private landowners, collaborate to provide places for people to live, work and play while protecting the mountains and seashore for future generations.



Restoring Parklands in the Santa Monica Mountains

The Santa Monica Mountains' unique climate and diverse topography create a complex assemblage of vegetation communities including oak woodland, several types of chaparral, coastal sage scrub, valley oak savannah, grassland, riparian woodland, wetland, and coastal marsh. This vegetation diversity provides abundant habitat for wildlife including 50 species of mammals, close to 400 bird species, and over 35 reptile and amphibian species.

Although 90 percent of the park contains natural habitat, more than half of these areas are privately owned. The greatest threats to the park's natural resources are impacts associated with transformation from natural open space to developed areas. An example is seen in the lower hills and coastal areas of the park, consisting primarily of *coastal sage scrub*. This plant community is considered one of the most highly disturbed communities in both the park and wider southern California.

The Santa Monica Mountains contain nearly 900 native plant species and 300 non-native species (25%!), such as mustard, fennel, and thistles. These non-natives often cause native plants and wildlife to diminish or disappear. To increase biodiversity and help protect our natural resources, the National Park Service is working to restore vegetation in many areas of the Santa Monica Mountains.

Restoration of the Santa Monica Mountains requires a large and continual labor force to accomplish the park's objectives. Your participation, and the collaborative efforts of volunteers and National Park Service staff, is not only restoring native vegetation, but improving water resources and wildlife habitat. In addition, the National Park Service is accomplishing a larger goal: educating our future land and sea protectors.

We thank you in advance for your help and look forward to your visit.

On-Site Program

Arrival

You will arrive at Zuma Canyon around 10:00am. A staff member will greet the students on the bus and provide **guidelines for a safe and enjoyable visit**. Students will then get a **short restroom break** before gathering at the picnic area.

Lesson

At the picnic area, students will receive a brief **introduction to the park and a lesson** on invasive plant species and wildlife impacts.

Interpretive Hike

Following the lesson, staff members will lead students on a **short hike (1/4 mile)** through the canyon, returning to the restoration site. This is an excellent opportunity for the students see the park environment up close and personal. The hike travels among several plant communities: riparian, chaparral, woodland, grassland and coastal sage scrub. Students will see the biodiversity of these communities and the adaptations the plants have developed to thrive in a Mediterranean ecosystem.

Restoration

Once you arrive at the restoration site, students will receive instructions on **weeding and planting**. Each station lasts approximately 25 minutes, with a **5-minute water break** between stations.

Weeding

In this station, students will remove invasive weeds such as black mustard, Italian thistle, euphorbia. For their protection, students will be provided with work gloves and should **wear their own long-sleeved shirts**. Park service staff will show how to remove the weeds from their roots. All weeds will be hand-pulled; no garden tools will be used.

Planting

Planting is a delicate process. Proper technique must be used to ensure the plants' survival. Therefore, students will be given a thorough demonstration of the planting process. Students will work in pairs and be **provided with gloves, shovels and hoes**.

Conclusion

After the restoration stations, the students will be brought back together for a **wrap-up**. The full program will last approximately 2 hours, not including lunch.

Lunch

Picnic facilities are available if your group wishes to stay for lunch, but food and beverages are not sold at the site. Your group will need to **bring lunches**. Even if you bring other drinks for lunch, have students **bring their own water** for the hike and restoration work.

Field Trip Preparation

Important Documents:

For each class or group: please complete one “Sponsored Voluntary Services” form, signed by the teacher or administrator, and bring on the day of field trip.

For each student: please have each student complete one “Parent Approval” form, signed by a parent or guardian, and bring on the day of field trip.

Please use the master copies of these forms provided in this information packet. A staff member will collect these forms on the day of the field trip before the program begins. Please note that park policy requires each individual/group in the program to complete these forms. **If forms are not completed, students can not participate.**

Clothing: Wear clothing appropriate for outdoor activities. For their safety, students must wear long pants and comfortable, closed-toe shoes (tennis shoes are fine). They may wear short-sleeved shirts, but should bring a long-sleeved shirt for weeding activities. Students must be prepared to be outdoors for the entire program in variable weather conditions. **Please bring sunhats, sunscreen and jackets.**

Cameras: Teachers and chaperones may use cameras. However, student use of cameras is distracting and should be discouraged during the program. Students are more than welcome to take pictures during their lunch period after the program has finished.

Rules: The group will be informed of all regulations at the beginning of the program. Students should be reminded that everything is protected within National Park boundaries. **Thus, picking flowers, collecting rocks, disturbing wildlife, etc. is prohibited.**

Tool Safety: The students will be given a demonstration at the restoration site on how to properly use their garden tools. Horseplay will not be permitted during the program, especially when working with garden tools. **If a student is disruptive or handles a tool in an unsafe manner, he/she will be removed from the activity.**

Supervision: Leaders are responsible for the proper behavior of their group. Rangers will not be expected to maintain discipline. Be sure that the chaperones are adequately dressed and prepared; they should be able and willing to participate in all activities, including a short hike (1/4 mile).

Safety: There are many hazards when working outdoors that the students should be aware of. Rattlesnakes, bees, ticks, and poison oak are all part of the natural environment. Upon arrival, students will learn how to avoid these hazards and be alert to other safety concerns. Students with allergies should bring their allergy medication (especially for bee stings). Weeding and planting activities will raise small amounts of dust and pollen.

Questions? If you have any questions regarding your visit, please call the Program Coordinator at (805) 370-2314.

**** Note: This form to be signed by TEACHER or ADMINISTRATOR, one form ONLY. Please bring on day of trip.**

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
VOLUNTEERS-IN-PARKS PROGRAM

Santa Monica Mountains National Recreation Area

Agreement for Sponsored Voluntary Services

NAME OF SPONSOR, ORGANIZATION, OR EVENT

ADDRESS (Street, city, state, zip code)

CONTACT PERSON (Teacher / Liaison for day-to-day operations)

WORK TELEPHONE (Including area code)

HOME TELEPHONE (Including area code)

Brief description of work to be performed, including minimum time commitment required.

Students will work to support native habitat restoration in the Santa Monica Mountains including hiking, removing invasive species by hand, digging holes, planting native species, watering plants, cleaning up the work sites and moving plants and equipment. Students will use garden tools including, but not limited to: shovels, hoes and rakes. Students will be given proper safety instructions and will work approximately 1 hour. Injury compensation is applicable only during this work period.

We agree to obtain parental or guardian consent for each individual under 18 years of age and to comply with applicable child labor laws. We understand that the individuals volunteering under this agreement will not receive any compensation for the above work, that they will NOT be considered to be Federal employees for any purpose other than tort claims and injury compensation, and that volunteer service is not creditable for leave accrual or any other employee benefits. We also understand that either the National Park Service, or we, may cancel this agreement at any time by notifying the other party. We agree to provide the National Park Service with a listing of active participants and the number of hours each contributed, as requested on the day of program.

Teacher / Administrator Signature

Date

The National Park Service agrees, while this arrangement is in effect, to provide such materials, equipment and facilities that are available and needed to perform the work described above and to consider you as a Federal employee only for the purpose of tort claims and compensation for work related injuries.

NPS Signature

Date

TERMINATION OF AGREEMENT

Agreement Terminated on

Month, Day, Year

Signature of Park VIP Coordinator

(1-83)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
VOLUNTEERS-IN-PARKS PROGRAM

Santa Monica Mountains National Recreation Area

Parental Approval Form

NAME OF VOLUNTEER

PARENT OR GUARDIAN'S NAME

ADDRESS

PHONE: (Residence)

(Business)

I affirm that I am the parent/guardian of the above named volunteer. I understand that the National Park Service's Volunteers-In-Parks program does not provide compensation (except as otherwise provided by law) and that the service will not confer on the volunteer the status of a Federal employee. I have read the following description of the work that the volunteer will perform.

Students will work to support native habitat restoration in the Santa Monica Mountains including hiking, removing invasive species by hand, digging holes, planting native species, watering plants, cleaning up the work sites and moving plants, pots and equipment. Students will use garden tools including, but not limited to, shovels, hoes and rakes. Students will be given proper safety instructions and will work approximately 1 hour. Please see full position description on the back of this form.

I give my permission for _____ to participate in this

program sponsored by _____
(Name of sponsoring organization, if applicable)

at Santa Monica Mountains NRA from _____ to _____
(Name of park or office) (Date) (Date)

(Parent / Guardian Signature)

(Date)



Santa Monica Mountains National Recreation Area

Position Description – EcoHelpers Restoration Volunteers

Introduction

The EcoHelpers program is a plant restoration and education program established by the National Park Service at Santa Monica Mountains National Recreation Area.

Major Duties

These projects may include non-native plant removal and restoration of native plant species.

Benefits

The EcoHelper student volunteers will provide valuable support to vegetation management goals that will directly affect natural resource management within the park now and in the future. Students will also learn about local wildlife, endangered species, and watershed ecology.

Physical Demands and Work Environment

Tasks require the students to work outdoors in the typical chaparral or grassland environment of southern California. Tasks such as removing non-native weeds and planting native species may require a person to bend, stoop, or kneel in outdoor climates common to the Santa Monica Mountains. Shovels and other tools common to gardening may be used by the EcoHelper students. With prior notification to park staff, efforts will be made to offer students with disabilities the opportunity to participate.

Safety

At the beginning of the EcoHelper project, park staff will give the students a thorough presentation on working safely and proper use of any hand held tools. Park staff will be present for the entire project to help ensure a safe environment for everyone.

Project Time

The EcoHelpers education program, guided walk, and project work will not exceed 3 hours.

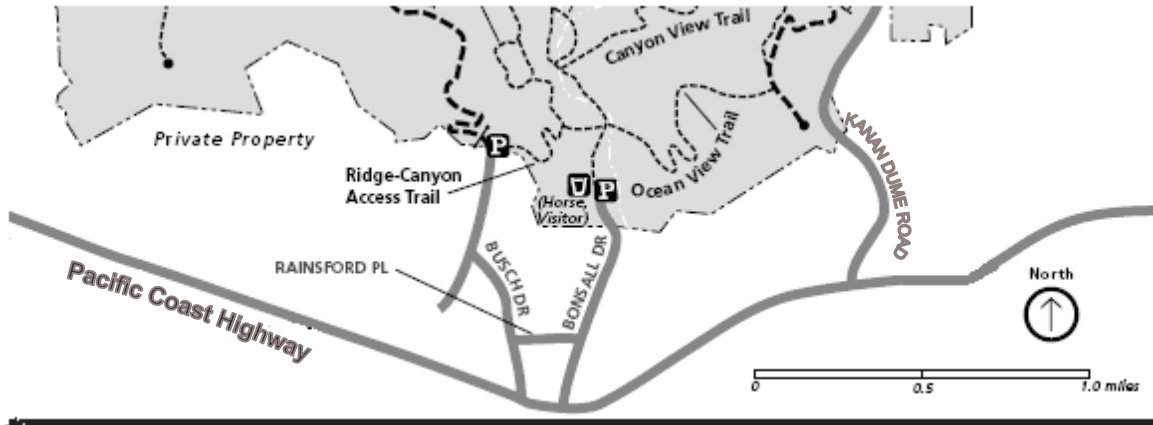
Supervision

Once the students arrive on-site, National Park Service staff will supervise the program with the support of school staff accompanying the students. Teachers and chaperones will maintain student discipline at all times.

PD32/Feb06

Map and Directions

To: Zuma Canyon, 5700 Bonsall Drive, Malibu, CA 90265



From Ventura Fwy (101) Las Virgenes Exit:

Exit Las Virgenes Road in Calabasas, head SOUTH toward Malibu and Pacific Coast Hwy (1). Turn RIGHT onto Pacific Coast Hwy (1) heading NORTH (actually West). Go one mile past Kanan Dume Road, turn RIGHT onto Busch Drive (at the stoplight, just past Zuma Beach turnoff). Turn right at the first street - Rainsford Place. Cross the creekbed and continue to Bonsall Drive; turn left and continue to the end. Proceed onto the one-lane dirt road leading into the parking lot.

From Ventura Fwy (101) Kanan Road Exit:

Kanan Road is closed to vehicles over 8000 pounds or more than two axles, between Mulholland Highway and Pacific Coast Highway. Please use Las Virgenes Road -- see directions above.

Exit Kanan Road in Calabasas, head SOUTH towards Malibu and Pacific Coast Hwy (1). Turn RIGHT onto Pacific Coast Hwy (1) heading NORTH (actually West). One mile down PCH, turn RIGHT onto Busch Drive (at the stoplight, just past the Zuma Beach turnoff). Turn right at the first street - Rainsford Place. Cross the creekbed and continue to Bonsall Drive; turn left and continue to the end. Proceed onto the one-lane dirt road leading into the parking lot.

From Santa Monica Fwy (10):

Heading WEST towards Santa Monica where the Santa Monica Fwy (10) becomes Pacific Coast Hwy (1). Continue on Pacific Coast Hwy (1) heading NORTH (actually west) toward Malibu for approximately 16 miles. Pass through the town of Malibu, continue one mile beyond Kanan Dume Rd, and turn RIGHT onto Busch Drive (at the stoplight, just beyond Zuma Beach turnoff). Turn right at the first street on the right - Rainsford Place. Cross the creekbed and continue to Bonsall Drive; turn left and continue to the end. Proceed onto the one-lane dirt road leading into the parking lot.

Educational Standards

The EcoHelpers program is curriculum-based and focuses on science principles learned through authentic restoration activities in a national park. The following standards are addressed during our pre-trip, post-trip and on-site lessons.

Science Content Standards for California Public Schools (Grades 9-12)

Ecology

- Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
 1. *Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
 - **Pre-Trip Lesson: “Strangers in Paradise”**
 - **On-Site Activity: Interpretive Hike**
 2. *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species, or changes in population size.
 - **Pre-Trip Lesson: “Strangers in Paradise”**
 - **On-Site Lesson: “Invasion of the Native Snatchers!”**
 - **On-Site Activity: Interpretive Hike**
 - **On-Site Activity: Restoring Santa Monica Mountains**

Earth Sciences: Energy in the Earth’s System

- Climate is the long-term average of a region’s weather and depends on many factors. As a basis for understanding this concept:
 1. *Students know* the effects on climate of latitude, elevation, topography and proximity to large bodies of water and cold or warm ocean currents.
 - **Pre-Trip Lesson: “Strangers in Paradise”**
 - **On-Site Activity: Introduction to the Mediterranean Ecosystem Interpretive Hike**

Los Angeles Unified School District - Student Learning Standards - Science

Upon completing two years of high school science in the LAUSD, students will be able to:

- Analyze and explain the interdependence of organisms in ecosystems, the role of genetic inheritance and the patterns and processes through which organisms and ecosystems change over time. (Life Science)
 - **Pre-Trip Lesson: “Strangers in Paradise”**
 - **On-Site Activity: Interpretive Hike**
 - **On-Site Activity: Restoring Parklands in the Santa Monica Mountains**

Upon graduation from LAUSD, students will be able to:

- Evaluate proposed solutions to challenges facing the earth and its inhabitants through the application and integration of the main concepts of the various branches of science. (Application and Connections)
 - **Post-Trip Lesson: “Restoration around the World”**

Program Themes, Goals & Objectives

Theme

Removing non-native invasive plants and restoring with native plants will improve the habitat for wildlife in the Santa Monica Mountains.

Goals

Students will:

- Comprehend that invasive, non-native plants can damage the natural communities that produce food and shelter to sustain native wildlife.
- Recognize that improving natural communities can improve native habitats, food chains, and the local food web.

Objectives

Students will be able to:

- Name 2-3 non-native plants threatening the biodiversity of the Santa Monica Mountains NRA.
- Describe the habitat of 2-3 local animals that will benefit from restoration.
- Demonstrate an understanding of the importance of biodiversity.

Pre-Trip Lesson: Strangers in Paradise

Lesson: Strangers in Paradise

Concepts: Ecology, biodiversity, non-native species

Standards Addressed:

- *Students know* biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats (California Science Content Standards, 9-12).
- *Students know* the effects on climate of latitude, elevation, topography and proximity to large bodies of cold or warm ocean currents (California Science Content Standards, 9-12).
- *Students will be able to* [recognize] the interdependence of organisms in ecosystems, the role of genetic inheritance and the patterns and processes through which organisms and ecosystems change over time (LAUSD Student Learning Standards-Science).

General Goals:

- To help students understand that non-native plants degrade biodiversity and damage natural plant communities.
- To help students understand the importance of restoring Santa Monica Mountains for the preservation of biodiversity and the protection of endangered species.

Specific Objectives:

- Students will read the article, *Strangers in Paradise* and discuss concepts of biodiversity, non-native species and management techniques.
- Students will read the background information, *Santa Monica Mountains National Recreation Area, Restoring Santa Monica Mountains and The Restoration Cycle*.
- Students start an ongoing field trip journal and complete their journal assignment.

Materials:

Strangers in Paradise article The Restoration Cycle
Restoration at Santa Monica Mountains Journal Questions

Anticipatory Set: Teacher writes the California content standard of biodiversity on the board:

Biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

Procedure:

- Teacher hands out the articles, *Strangers in Paradise* (pp.18-20), *Santa Monica Mountains National Recreation Area* (pp.4-5), *Restoring Santa Monica Mountains* (pp.6-7) and *The Restoration Cycle* (pp.22-23) to every student in the class.
- Students take turns reading *Strangers in Paradise* out loud.
- Teacher leads a discussion on the concepts of biodiversity, non-native species and management techniques using the following questions (pg. 21):
 1. What is biodiversity? Why is it important?
 2. What non-native plant is threatening the Hawaiian rain forests? Why?
 3. Why are non-native species a major concern for Hawaii?
 4. How are non-native species introduced to different parts of the world?
 5. What management techniques do biologists use to control invasions of non-native species?
- Students read *Santa Monica Mountains National Recreation Area*, *Restoring Santa Monica Mountains* and *The Restoration Cycle* to prepare them for the field trip.

Closure: Teacher may tell students that they will all have the opportunity to help Earth's biodiversity crisis by helping to restore native plant communities in Santa Monica Mountains. Teacher will instruct students of proper field trip procedures and may answer any final questions about the field trip at this time.

Assignment: Teacher instructs students to start an ongoing field trip journal, where they will define new vocabulary and write down their thoughts and questions, in addition to completing lesson assignments. Students will answer the journal question sheet for this lesson.

STRANGERS IN PARADISE

by Laurel Murphy

[Reprinted with permission from *Nature Conservancy* (January/February 1996:28-33). Copyright 1996 by The Nature Conservancy.]

We are hot. We are sticky. We are covered with mosquitoes to the point, someone jokes, of inhalation. We are on the Hana coast of Maui, tracking down *Miconia calvescens*—A plant that could destroy the native Hawaiian rain forest. The problem: *Miconia* spreads like wildfire, choking out slow-growing native plants, leaving room ultimately for nothing but itself.

Our party consists of some of the most able conservationists on the island. Among them: bearded, bespectacled Bob Hobdy, Maui's state forester, and Lloyd Loope, a research scientist with the National Biological Service at Haleakala National Park. Also with us are The Nature Conservancy's director of science and stewardship, Alan Holt, and alien-species manager Pat Bily.

This concatenation of interagency talent has converged on a nasty piece of land 600 feet above sea level. They all help manage portions of the great primeval rain forest on the upper, windward slopes of the dormant volcano of Haleakala. Here, among the centuries-old, moss-laden trees, Hawaii's beautiful and endangered forest birds cling precariously to life: the yellow *nukupu'u* with its curved bill; the *akohekoho*, with its professorial crest; and the brown and black *po'ouli*, discovered only 20 years ago.

But that, alas, is not where we sweat-drenched few are headed. Instead, we are making our way towards stands of *miconia*, a biological pollutant from Central America that has invaded 70 percent of the native forest in Tahiti since its introduction in 1937. Left unchecked for 50 years, it would do the same to Maui.

Miconia is a pretty plant, valued by horticulturalists for its velvet-like surface and distinctive purple underleaf. However, the incredible volume of seeds a single mature individual is capable of producing—as many as 20 million—form a catastrophe in the making. In Tahiti, *miconia* is known as the “green cancer.”

And it has come to Hawaii.

“Look at this!” Hobdy calls. We have arrived at the largest known stand of *miconia* on Maui, where the state has begun a campaign to retard its growth by helicopter spraying. It has worked. All around us are bare or dropping trees. Hobdy,

however, is pointing to a rotted tree trunk where thousands of new *miconia* seedlings are flourishing even as their parents are dying.

“We're just buying time,” he says of the aerial control strategy. “The real success of this mission is to get in on the ground. If we don't, we won't get anywhere.”

Grim as this picture looks; it is a success story in the making. The plant's spread was spotted early. And fighting it is a priority of the East Maui Watershed Partnership, a multi-agency effort to preserve Maui's watershed and the native forest that nourishes it. Given continued funding, this could become another victory in the war scientists in Hawaii wage daily against the pervasive threat of alien species.

The alien-species problem is grave in the Pacific crossroads of Hawaii, but it is not isolated. California and Florida are both fighting large numbers of exotic pests. “We have a more severe problem in Hawaii,” Holt says. “But we think it's an example of what faces virtually all parts of the world in the future.”

The tremendous biodiversity of Hawaii has been called a national treasure. “Mile for mile, this is the biggest place on Earth,” National Biological Service research assistant Art Medeiros says of Haleakala National Park. “These few miles make a vital contribution to the biodiversity of the United States and the world.” The same could be said for much of the state.

The Hawaiian Islands are the most remote land mass in the world, separated from the nearest continent by 2,500 miles of ocean. Only a few kinds of plants, insects and birds managed to establish colonies here, eventually evolving from the original several hundred species into thousands, more than 90 percent of which are endemic to the state. Because of this, Hawaii is considered an exemplary natural laboratory for the study of evolution. “It's hard to imagine a greater isolation for the original species which got here,” says Medeiros, a gifted botanist who spends long hours in the field. “It's the original free lunch.”

But the menu has changed. The human settlers who have arrived over the past 1,500 years have brought with them non-indigenous species. Some of them, such as sugar cane and pineapple, have been useful, and, in fact, form the basis of most of Hawaii's agriculture industry and the landscape that visitors see. Others, such as domesticated pigs and goats, have been deadly.

According to a 1993 report by the U.S. Congress' Office of Technology Assessment

(OTA), Hawaii is now considered the worst-case example of the nation's non-indigenous-species problem. Hawaii is the fourth smallest state, amounting to only 0.2 percent of the land mass of the country. Yet a third of the plants and birds listed or being considered for federal endangered species status belong to Hawaii. And much of the island's unique plant and animal life is already gone, destroyed by habitat loss and the spread of alien species. Of the plants and birds known to have gone extinct in the United States, three-quarters are from Hawaii. More than half of the native bird species are extinct. Of the 44 remaining, 29 are listed as endangered. And the plants aren't faring much better. At least a tenth of Hawaii's native plants are extinct, and 30 percent to 50 percent of those remaining are considered threatened or endangered.

"It's a biological crisis," says Hobdy.

Although the situation in Hawaii is unique, the OTA report says it heralds what other states will soon face if harmful non-indigenous species continue to enter the United States and are allowed to spread. More than 4,500 species of foreign origin have established significant populations in the United States, approximately 15 percent of which now cause severe economic harm. About 80 non-indigenous species caused losses of \$97 billion between 1906 and 1990. A worst-case scenario for 15 potential high-impact alien species posits another \$134 billion loss in the future.

One such unwelcome invader is the zebra mussel, a clam from the Black Sea that was carried to the Great Lakes in ballast water. It has now proliferated throughout midwestern rivers and lakes, clogging intakes to sewage treatment plants, fouling ships' hulls and waterways, depriving native species of food and causing millions of dollars' worth of damage. Other costly pests are melaleuca trees from Australia, which are rapidly degrading the Florida Everglades by competing with indigenous plants, and the kudzu vine sweeping the South. This Southeast Asian legume, introduced for cattle fodder some years ago, has since demonstrated an unfortunate ability to choke off everything in sight.

"People need to realize it's all one phenomenon," says Holt. "The problem is the worldwide spread of alien species—whether it's a disease organism, a plant virus for soybeans, or a Central American weed invading Hawaiian forest. The bottom line is, how do we as a species foster the global community without undermining the planet's ecology?"

Conservation efforts in the Hawaiian Islands are focusing on ridding parks and nature preserves of the pigs and goats whose browsing, rooting and trampling destroys vegetation, hastens erosion and opens the way for other introduced animals and plant pests (see "Pigs vs. Hawaii's Rain Forest," *Nature Conservancy* [May/June 1994]: 38-39).

"These animals are destroying our forests," Hobdy says bluntly. "If the animals didn't tear the place up, the weeds wouldn't be able to invade."

Pioneering efforts in the 1970s to control pigs and goats at the vast, volcanic reaches of Hawaii Volcanoes National Park on the Big Island of Hawaii spurred programs on other islands to do the same. Thousands of pigs and goats roamed the wild terrain in Haleakala National Park when scientist Loope arrived in 1980. Federal funding was obtained to fence the park against these destructive ungulates, a task that was completed by the start of this decade. One short year after the fence went up, Medeiros recalls seeing native grasses sprout back on the cliffs where he formerly thought nothing could grow.

The same is true for The Nature Conservancy's Waikamoi Preserve, which sits just below the national park at an elevation of 6,000 feet. It, too, is now largely fenced, a heroic task undertaken by staff and volunteers who spent days in the rain getting materials across deep, slippery ravines. The goal is to do the same in the pristine forests on East Maui Watershed Partnership lands.

It is a misty day at Waikamoi, and Mark White, The Nature Conservancy's Maui program manager, is leading us on the Rose Gardner Memorial Boardwalk to an area where the ghostly, ancient native *ohia* tree looms from the forest floor, surrounded with fern growth newly re-established after the exodus with the pigs.

Behind us, the whine of a truck shatters the calm. It is a Nature Conservancy field crew, on the trail of a new threat, the axis deer. Introduced to Hawaii for game hunting, the deer have ruined native dry land forest on the islands of Lanai and Molokai. Now, their Maui population has grown to threatening size. ("Think of all the fences we built to keep the goats and pigs out." Bily says, singing the alien species control manager's blues. "Now here Bambi comes and jumps right over it.") Conservationists will probably look back at the era of ungulate control as the good old days compared with the current

alien-species menaces that loom on the horizon. "I'm sorry, that's the easy stuff," says Holt.

One morning last spring, Holt's telephone rang with an unusual call. It was Nainoa Thompson, chief navigator aboard the *Hokule'a*, one of six Polynesian voyaging canoes on an epic journey from the Marquesas to Hawaii, sailing in the traditional manner using only the sea and the stars for navigational aids.

"So, when you left the Marquesas did you clean your boots?" Holt joked, expecting this to be a courtesy call.

There was a pause on the line. "Um, well, that's why we're calling."

It turned out that a nasty, biting Marquesan sand fly—which would deal a blow to the Hawaiian tourist industry if it ever got established—had stowed away, breeding in traditional food offerings given to the crew. The planned triumphal re-entry to Hawaii was scratched (by the crew's choice) in favor of an ignominious and thorough fumigation offshore—the mast dropped, sails doused, boat towed, all plant material destroyed.

That's another success story—one invader whose entry into paradise was arrested because the travelers cared. But many, many others are on the way; their passage made easier by Hawaii's fractured inspection system for airlines, ship cargo and first-class mail. Unless swift action is taken, Holt believes that fire ants, killer bees, ticks that carry Lyme disease, and new kinds of harmful mosquitoes are not far away.

Looming too, like an evil spectre in the Garden of Eden, is the brown tree snake from Guam. This nocturnal nightmare—which adapts easily to any environment, including airports—entered Guam after World War II aboard ships from its home in the South Pacific. Since then, it has bitten 200 people in Guam, 73 percent of them in bed asleep. It has eaten all the wild populations of 9 of Guam's 11 endemic bird species, caused power outages an average of every four days for the past three years, and regularly slithers through unscreened toilets and air vents.

The U.S. Department of Defense, however, has cut funding for military customs, whose agents inspected outgoing traffic in Guam for the snake. Given that, and other gaps in the

protection net, it may be just a matter of time before the snake comes to Hawaii. If it does, a jump to the U.S. mainland may not be far behind. And what of the possibility of a malaria-bearing mosquito coming to Hawaii aboard one of the aircraft that lands every minute and a half at Honolulu International Airport? A campaign to spray incoming airplane cabins with insecticide was stopped by passenger complaints long ago.

"This alien-species thing is not going to go away," Medeiros says. "It's only going to become more and more profound. I believe the problem of nature preserves will get shunted aside in the future. We'll have more crucial issues to deal with."

According to Holt, the perilous time bomb of alien species now cuts across every area of life in Hawaii—tourism, agriculture, the economy, public health. "The biological traffic into Hawaii is so dramatic we're at risk of losing our economy," he says.

Holt has helped form a new task force, the Coordinating Group on Alien Pest Species, which has brought influential officials from the tourism industry, the military, and business together with policy-makers in the state and federal governments. They plan to introduce legislation to attack the problem, and recently released an action plan that calls for a coordinated effort to tighten up the gaping loopholes in the current system. (Step one: a massive education campaign.) "It's not OK to do a little bit better than we have been doing," Holt says. "We've got to make significant improvements."

Up in the mists of Waikamoi, we have all fallen silent, walking back to the van from the realm of dripping ferns and great trees, lost in our own thoughts. At the end of the boardwalk, in a clearing, some of us see our first *'iwi*—scarlet and black, scimitar-billed, a tiny native Hawaiian bird hopping delightedly on a branch.

It seems a symbol of hope, a little message that all is not lost.

"I think what we do here in Hawaii will help lead the way for what the country needs," Holt says. "The problems are more dire here. But they're not unique. The solutions we find here will be valuable to the rest of the country. We take that seriously."

Discussion Questions for “Strangers in Paradise”

1. What is biodiversity? Why is it important?
2. What non-native plant is threatening the Hawaiian rain forests? Why?
3. Why are non-native species a major concern for Hawaii?
4. How are non-native species introduced to different parts of the world?
5. What management techniques do biologists use to control invasions of non-native species?

The Restoration Cycle

To restore something means to bring it back to its original state. Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Types of damage might include invasion of non-native plants and animals, overgrazing by native or non-native animals, pollution of soil or water and alteration of landscape features such as hills, valleys or streambeds.

Ecologists try to restore ecosystems to their original native state. They might examine surrounding areas or places with similar climate, soils and other physical features, to find what an area might be like without disturbance.

Restoration can be passive or active. Some areas will restore themselves through natural regeneration if the disturbance is removed. Other areas need assistance in both disturbance removal and plant recovery. Restoring native plant habitats takes place on a yearly cycle. Timing is determined by factors such as weather, when plants bloom and when they go to seed. The five stages of restoration are **planning, removal of invasive species, propagation, revegetation, monitoring and maintenance.**

When **planning** a restoration cycle, first one must identify the current conditions by noting certain factors such as disturbance, local climate, soils and current vegetation. The most problematic non-native plant in the Santa Monica Mountains is *Euphorbia terracina*, also known as Geraldton Carnation Spurge. This weed invaded the canyon in recent years and has begun to overtake native vegetation. The next step in planning is to identify the best techniques for addressing the disturbance or degradation. Park ecologists have decided to use a combination of hand pulling and spraying of herbicide to remove non-native plants, followed by revegetation with native plants. The last step is to choose a desired outcome and make a schedule of implementation. For our outcome, we would like to see the majority of the Santa Monica Mountains populated by native vegetation appropriate to the area.

When actually performing a restoration project, disturbances or degradation must be treated. In the Santa Monica Mountains, invasive, non-native plant species must be

removed. This is the process of treating disturbances or degradation. Non-native plants are those occurring as a result of deliberate or accidental actions by humans. In southern California, they have been introduced through agriculture, livestock grazing, forestry, ornamental landscaping, or soil stabilization. When non-native plants are brought here from other Mediterranean climates, they can easily invade and spread through our ecosystems, displacing native plants and decreasing biodiversity.

When and how invasive, non-native plants are removed varies depending on the characteristics and life-cycle of the species. Some plants, such as mustard, are annual plants and only grow during a brief period. It is important to remove annuals before they can go to seed. Perennial plants can be removed throughout the entire year.

Propagation is the growing of plants from seeds and cuttings (propagules). The park staff at Santa Monica Mountains National Recreation Area propagates the plants needed for habitat restoration in the park's own native plant nursery. Propagules for revegetation are collected either from the restoration site itself or from surrounding areas since they are more likely adapted to thrive in that area. Propagules are collected in the spring or fall, depending on the life-cycle of the species.

Revegetation is providing an area with a new plant cover. Once invasive, non-native species have been removed, native plants similar to the surrounding mix are planted to help the habitat recover.

Monitoring and **maintenance** are both key elements in ensuring the continued success of the restoration project. **Monitoring** is the collection and analysis of data at regular intervals over time. It is used to predict or detect natural and human-induced changes and to provide a proper response. Monitoring continues for many years after the restoration work has been completed and is crucial for planning future restoration projects. **Maintenance** involves the long term care of the restoration site. This can include watering, continued weeding and replanting, among other tasks. Monitoring and maintenance are the most important steps in determining the long-term success of a restoration project.

Journal Questions

1. Define restoration. What are the five stages of restoration?
2. Define biodiversity. Why is biodiversity important?
3. Why are non-native species harmful to natural communities?
4. Why did the National Park Service decide to concentrate their efforts on restoring the Santa Monica Mountains?
5. What is the mission of the National Park Service?

Post-Trip Lesson: Restoration Around the World

Lesson: Restoration Around the World

Concepts: Magnitude of restoration worldwide; diversity of restoration projects

Standards Addressed:

- *Students will be able to* evaluate proposed solutions to challenges facing the earth and its inhabitants through the application and integration of the main concepts of the various branches of science (LAUSD Student Learning Standards-Science).

General Goal: To help students understand that people around the world are working together to restore degraded habitats and preserve species.

Specific Objectives:

- Students will discuss articles about different habitat restoration projects throughout the globe. Students will compare and contrast **worldwide** habitat restoration with the restoration project in the Santa Monica Mountains.

Materials:

- Internet
- 5 articles about habitat restoration in different parts of the world
- Discussion questions

Anticipatory Set: Teacher writes the following quote on the board:

The wedges of development are being driven hard and none of the obstacles or defenses of nature can long withstand the onset of this immeasurable industry.

-John Muir

Procedure:

- Teacher performs an internet search (before class or with class) to find different restoration projects around the world. Type in the key words, *habitat restoration*, at any internet search engine to find various restoration projects.
- Teacher explains to the class that Santa Monica Mountains National Recreation Area's restoration project fits into a much larger picture of restoration projects worldwide. Today students will learn about some other restoration projects and have a chance to compare the Recreation Area's project to others. Each student is given one of the five articles on restoration projects or finds their own project on the internet.

- Students read their articles. After reading the articles, students divide into groups by article. In their groups, students discuss their article and answer questions 1-8.
- Students “jigsaw”: Form new groups of four in which one representative from each of the original groups is present in the new group. In the new groups, students present the restoration project they read about. Students answer questions 9-11.

Closure: The class comes together and the teacher leads a discussion on the purpose of restoration. In Santa Monica Mountains National Recreation Area, the goal of restoration is to increase plant and animal diversity and protect endangered species. Is this a valid goal? How does it compare to the goals of the other restoration projects? Considering other environmental challenges, how important is restoration? Who benefits from restoration of natural areas?

Restoration Around the World

Discussion Questions

TO BE DISCUSSED IN FIRST GROUPING:

1. What is the goal of this restoration project?
2. If successful, who or what will benefit from this project?
3. Does this project benefit people of all economic classes? Why or why not?
4. Who is sponsoring or funding this restoration work?
5. Does this project show collaboration between interest groups or is it a one-sided effort?
6. Who might be against this project? Who or what does it affect negatively?
7. How does this project address endangered species and their protection?
8. What is your opinion of this project?

TO BE DISCUSSED IN SECOND GROUPING:

8. Do you think one of these projects is more important or valuable than another?
9. If you had to choose only two of the four projects, which two would you choose? Why?
10. Compare these projects to the restoration project you participated in at Solstice Canyon in Santa Monica Mountains National Recreation Area. What are some similarities? ...differences?

Appendix A: Plant Communities of Santa Monica Mountains

Chaparral: indigenous to Mediterranean climates, the chaparral is primarily composed of large, dense evergreen shrubs with small, leathery leaves adapted to fire and drought. This community is found on dry, rocky slopes within the mountains, at higher elevations than coastal sage scrub and often adjacent to it. Native chaparral shrubs include: chamise, toyon, laurel sumac, red shanks, manzanita and ceanothus.

Coastal sage scrub: consists of a variety of short, soft-leaved shrubs that drop their leaves during summer months. Coastal sage scrub is found on the lower slopes and plateaus of the mountains, occurring at lower elevations than chaparral. Plants of the coastal sage scrub include: sagebrush, buckwheat, black sage, purple sage, bush mallow, coast goldenbush and monkeyflower.

Southern oak woodland: dominated by coast live oak trees, but may include valley oak trees; groves are located on slopes and ridges throughout the mountains. Shrubs and plants growing under these oaks are an important part of the woodland. Some plants include: coastal woodfern, coffeeberry, sugar bush, nightshade and poison oak.

Riparian woodland: found on the banks of a natural water-course, such as a stream or pond. The vegetation growing in this community is typically water-loving. Trees of the riparian woodland include giant sycamores, willows, black walnut and alders. Riparian plants growing in the shade of these tall trees include: blackberry, wild rose, nettle, mugwort and poison oak.

Valley grassland: occurs throughout the mountains in well-drained areas at all elevations. Most communities are small, occupying only a few acres of land. Many of our native needlegrass and bunch grasses have been replaced by introduced, non-native, annual weeds and grasses, such as black mustard, rye and wild oats. Intact grasslands may be dominated by several different grasses including purple needle grass and foothill needle grass.

Appendix B: Invasive, Non-native Plants of Santa Monica Mountains

Geraldton carnation spurge *Euphorbia terracina*:

- An invasive, non-native, perennial weed
- Mature plants 2' tall
- Small (1/4 inch) yellow-green, cup-shaped flowers in late spring and early summer
- Mostly short green, grass-like leaves, along with small green spade-shaped leaves near the flowers
- Reddish stems on older plants
- Thrives in disturbed areas
- Very aggressive, it has completely displaced native vegetation in some areas in the park
- Has a milky latex-like sap that is toxic and may cause a skin rash. It's toxins prevent growth of plants underneath it.
- Originally from the Mediterranean area of Europe

Black Mustard *Brassica nigra*:

- An invasive, non-native, grass
- Mature plants 2' - 8' tall
- Alternate leaves 4" - 8" long
- Flowers February to July
- 4 yellow flower petals arranged to form a cross
- Grows in meadows and disturbed areas in patches and dominates areas of a few acres or less

Yellow star thistle *Centaurea solstitialis*:

- An invasive, non-native herb
- Mature plant 1' - 2½' tall
- Yellow flowers less than 1" across, with purple or brown spines
- Believed to be from Europe or Asia
- Survives well in hot, dry areas of open sunshine

Milk thistle *Silybum marianum*:

- An invasive, non-native herb
- Mature plants grow up to 6' tall
- Alternate leaves on stem
- Large purple flowers with many petals are up to 2" in diameter and have a prickly green base
- Thrives in disturbed areas and can interfere with restoration
- Leaves are prickly and mottled white and green

Fennel or Sweet fennel *Foeniculum vulgare*:

- An invasive, non-native herb
- Mature plants 3' - 6' tall Flowers in large compound umbels
- Jointed stems look like large grass stems or bamboo, but with narrow feathery leaves
- Distinct odor of licorice
- Thrives in disturbed areas

Wild oat *Avena fatua*:

- An invasive, non-native, perennial grass
- Mature plants 1'-4' tall
- Seedlings with hairy foliage
- Light tan when dry, with white, paper-like open fruits shaped like a crab claw

Giant reed *Arundo donax*:

- An invasive, non-native, tall perennial grass
- Mature plants can grow 4" a day and up to 30' tall
- Large, flat leaves up to 2' long and 1½" wide
- Large flowering stalks visible from spring to late fall
- Stalk is jointed like bamboo
- It loves moist areas and is often found in riparian zones, but can be very invasive throughout watersheds
- Dried leaves can create a fire hazard

Poison hemlock *Conium maculatum*:

- An invasive, non-native herb
- Mature plants grow 10' tall
- Flower stalks, with large alternate leaves
- Minute flowers in compound umbels
- Entire plant is toxic and can cause serious health problems (or fatal) if eaten

Tree tobacco *Nicotiana glauca*:

- An invasive, non-native, evergreen shrub to small tree
- Mature plants 6' to 24' tall
- Alternate leaves that are 1" to 3" long and are ovate and bluish green
- Tubular, yellow-green flowers mostly seen in spring and summer
- Originates in South America
- Very aggressive and often found in disturbed areas

Castor bean *Ricinus communis*:

- An invasive, non-native plant
- Mature plants 3' - 10' tall
- Entire plant is very toxic, but mainly the seeds, if eaten
- Large seeds up to 3cm in length, covered with thick spines
- Large greenish-purple serrated leaves up to 1' in diameter, shaped like the palm of your hand

Glossary

Adaptation: any feature that allows a plant or animal to have a better chance of reproducing.

Airshed: a geographic area that, because of topography, meteorology, and/or climate, is frequently affected by the same air mass. Santa Monica Mountains NRA was created to enhance and improve the Los Angeles area airshed.

Annual: a plant that completes its life cycle in one growing season (compare to perennial).

Biodegradable: items capable of being broken down by microorganisms into products harmless to the environment.

Biodiversity: the sum total of different kinds of organisms in an area or ecosystem.

Blade: the wide, flattened part of a leaf, not including the leaf stalk.

Bur: a fruit with spines, usually hooked or barbed.

Catastrophe: a tragic sudden change in the feature of the earth.

Coexist: to live together without harming one another.

Domesticated: organisms that have adapted to live among and to the benefit of humans.

Drainage: an area through which runoff water drains; usually lower than surrounding areas.

Drainage basin: a large watershed usually referring to the combination of several watersheds.

Ecology: the science of the relationships between organisms and their environments.

Ecosystem: Collection of all the organisms that live in a particular place, together with their nonliving environment.

Endangered: any listed species that is in severe danger of becoming extinct throughout all or a significant portion of its range.

Endemic: arising from or unique to a given region or area.

Evolve: to change gene frequencies in a species over time.

Exemplary: serving as an example or illustration because of excellence; deserving imitation.

Exotic: see non-native.

Extinct: a species that no longer exists.

Foliage: the leaves of a plant or tree.

Fumigation: gassing or smoking out to disinfect or destroy pests.

Genetic diversity: the variability in genetic or hereditary make-up among individuals within a single species.

Genus: a taxonomic grouping of plants or animals that contains related species;
the first element of a scientific name.

Germinate: to sprout.

Habitat: the area and environment in which an organism lives.

Habitat restoration: to restore, or bring back, the ecological integrity of a community to its natural state.

Herbicide: plant-destroying chemical agent.

Horticulture: the science and art of growing plants.

Indicator species: a major component of communities that can be used to measure and assess the state of ecosystems.

Indigenous: having originated in a particular area or environment.

Insecticide: insect-destroying chemical agent.

Interdependent: mutually dependent; elements in an ecosystem depend on one another for survival.

Intermittent stream: a stream which has an interrupted flow or does not flow continuously, such as going underground or flowing after rainstorms.

Invasive: species (usually non-native) that have competitive survival and reproductive characteristics and can therefore out-compete native species.

Irrigation: the practice of supplying dry land with water.

Listed species: state or federal method of assigning status to a species under law. This status, usually in population categories of *rare*, *threatened* and *endangered*, protects designated species and their habitats; it requires any development to be halted or mitigated if a species is considered endangered throughout all or a significant portion of its range.

Livestock: domestic animals such as cattle or horses.

Macroinvertebrate: a spineless animal visible to the naked eye or larger than 0.5 millimeters.

Meander: the winding or sinuosity of a stream.

Mediterranean climate: primarily on the western edges of continents between the 30° and 40° parallels of latitude. The pattern is characterized by hot, dry summers and mild, wet winters.

Monoculture: an area covered exclusively by one species.

Native: species that originated in a given location.

Non-native: species that did not evolve in its present environment, but was introduced, deliberately or accidentally, by humans.

Non-indigenous: not having originated in a particular area or environment; non-native, exotic.

Opportunistic: a description of plants that take advantage of whatever is available in their environment in order to live and reproduce.

Perennial: a plant whose life cycle lasts for several years; the plant survives year after year without having to be replanted (compare to annual).

Perennial stream: a stream that flows continuously (year-round), such as Solstice Creek.

Pesticide: a pest-destroying chemical agent.

Plant communities: areas defined by the dominant plant species found within the community.

Pollutant: any substance or mixture of substances that contaminate the soil, water, or atmosphere.

Precarious: having a lack of stability that puts something at risk.

Predator: an animal that kills and/or consumes other animals.

Prey: an animal that a predator kills for food.

Revegetate: to reestablish vegetation in a restoration site by planting and seeding indigenous species.

Runoff: rainwater (with materials) carried over the land to another location.

Species: a group of plants or animals that are all alike, and able to breed and produce offspring in their environment.

Succulent: plants that have thick, fleshy tissues that store water and help them resist drought conditions.

Toxic: poisonous.

Threatened: any listed species that has a high risk of becoming endangered within the near future.

Transverse range: a rare type of mountain range which runs east and west (as compared to the usual north and south).

Watershed: the land area that sheds or drains into a particular river, river system or body of water.